

Using a Novel Sediment Exposure to Determine the Effects of Bifenthrin on Estuarine Benthic Communities Kay T. Ho, Lisa M. Portis, Anthony Chariton, Dina Proestou, Marguerite Pelletier, Mark Cantwell, Monique M. Perron, Robert M. Burgess, Stuart Simpson, Jeffery G. Baguley, Vinay Menons

Bifenthrin is a widely used pyrethroid insecticide that affects animal sodium ion channels in the peripheral and central nervous system of target and non-target species, eventually causing paralysis. It is a suspected human carcinogen and has been banned for use in the European Union; however in the United States over 600 products containing bifenthrin still exist.

Bifenthrin is moderately toxic to mammals (LD50 parts per million) but very toxic to fish and aquatic organisms (LC50s parts per trillion). It enters estuarine environments primarily via agricultural and residential use, and, because it is a hydrophobic compound ( $\log K_{ow} \sim 6$ ), it has the potential to accumulate in estuarine sediments. The objective of our research was to determine the effect of bifenthrin on intact estuarine benthic communities. We adapted a novel exposure method which brings intact sediment cores into the laboratory and then exposes the benthic community by addition of toxicant-spiked sediments to the sediment surface. Macro- and meiobenthic communities were analyzed for differences after a two-week exposure to the following treatments: 1) field control - no added sediment, 2) laboratory control - reference sediment added, 3) low bifenthrin concentration (8.5 mg/kg dry), and 4) high (68 mg/kg dry) bifenthrin concentration. Results from the bifenthrin sediment additions indicated a significant difference ( $p \leq 0.05$ ) in macrofaunal taxa community composition between the controls and both bifenthrin treatments as well as between the low and high bifenthrin treatments. Meiofauna data indicated a significant difference in community composition between the controls and the high bifenthrin exposure. We also noted a difference in the field control relative to the laboratory control, most likely due to a smothering effect of the added sediment. These data suggest that at elevated concentrations, bifenthrin can disrupt benthic communities while also indicating that the laboratory exposure system does not completely emulate exposures in the field.

Keywords:

Bifenthrin, benthic communities, sediments, macrofauna, meiofauna